

APPENDIX C-1: Master Surface Use Plan

June 15, 2001

Double Eagle Petroleum Company

**P.O. Box 766
Casper, Wyoming 82602
(307) 237-9330**

Cow Creek Area of Pod #6

Carbon County, Wyoming

Double Eagle Petroleum Company is proposing the drilling of eight(8) exploratory coalbed methane (CBM) wells near and in the Cow Creek Unit or Pod #6 of the Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Study in Carbon County, Wyoming.

The Atlantic Rim Environmental Impact Study will commence in 2001 and cover approximately 300,000 acres. The EIS is expected to take 18-24 months to complete. During the interim period before the EIS completion, the Bureau of Land Management will allow the drilling of up to 200 exploratory wells. Currently oil and gas operators have identified 9 areas or “Pods” where these exploratory wells will be located.

The Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Statement allows for the drilling of 24 CBM wells, 1 aquifer recharge well and 1 disposal well in Pod #6 located in portions of Sections 12 of Township 16 North, Range 92 West and Sections 7, 17 & 18 of Township 16 North, Range 91 West, Carbon County, Wyoming. 10 CBM wells and the disposal well located in Sections 8 and 17 of Township 16 North, Range 91 West will be operated by PEDCO/Warren Resources. The remaining 14 CBM wells and 1 aquifer recharge well in Pod #6 will be operated by Double Eagle Petroleum. This Master Surface Use Plan also serves as Double Eagle’s right of way application for operations proposed herein. **This Master Surface Use Plan focuses solely on the wells to be operated by Double Eagle Petroleum.**

The 14 CBM wells Double Eagle will operate in Pod #6 currently consist of 2 existing CBM wells, 4 existing and approved Permits to Drill, and 8 proposed locations. Of this total 14 wells/locations, 9 will be within the Cow Creek Federal Unit on federal leases C-07345B and C-075345A and WYW-48862. The remaining 5 proposed wells will be on federal lease #WYW-131275.

For purposes of this Master Surface Use Plan, Double Eagle has combined the surface use methods employed in its 2 existing CBM wells and 4 approved CBM locations with the proposed eight(8) new CBM locations and aquifer recharge well. This Master Surface Use Plan is not intended to modify the surface uses approved for its existing wells or locations, rather it is to compliment and coordinate the two plans. A topographic map showing the wells, approved APDs, proposed locations, access routes and pipelines is attached to this Plan as Exhibit “A”.

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Following is a list of the CBM wells and aquifer recharge well located within Pod #6 for which Double Eagle will operate:

<u>Well Name</u>	<u>Location</u>	<u>Lease</u>	<u>Status</u>
CCU #1X-12	NW¼SE¼ (12, T16N-R92W)	C-075345B	Producing
CCU #34-12	SW¼SE¼ (12, T16N-R92W)	C-075345A	Shut-in
CCU #32-12	SW¼NE¼ (12, T16N-R92W)	C-075345A	Approved APD
CCU #42-12	SE¼NE¼ (12, T16N-R92W)	C-075345A	Approved APD
CCU #43-12	NE¼SE¼ (12, T16N-R92W)	C-075345A	Approved APD
CCU #44-12	SE¼SE¼ (12, T16N-R92W)	C-075345A	Approved APD
CCU #12-7	Lot 6 (SW¼NW¼) (7, T16N-R91W)	W-48862	Application
CCU #13-7	Lot 7 (NW¼SW¼) (7, T16N-R91W)	W-48862	Application
CCU #14-7	Lot 8 (SW¼SW¼) (7, T16N-R91W)	W-48862	Application
DBLE #24-7	SE¼SW¼ (7, T16N-R91W)	W-131275	Application
DBLE #33-7	NW¼SE¼ (7, T16N-R91W)	W-131275	Application
DBLE #34-7	SW¼SE¼ (7, T16N-R91W)	W-131275	Application
DBLE #43-7	NE¼SE¼ (7, T16N-R91W)	W-131275	Application
DBLE #44-7	SE¼SE¼ (7, T16N-R91W)	W-131275	Application
ARW #1	SE¼NW¼ (12, T16N-R92W)	C-075345A	Application

The wells operated by Double Eagle are located on federal oil and gas leases C-07345B, C-075345A, W-48862 and W-131275. Lease WYW-131275 has a time stipulation from February 1st to July 31st for sage grouse and raptor nesting. All locations are covered within the area of wildlife analysis completed by Hayden-Wing and Associates for PEDCO/Warren Resources in Spring 2001. From that study, the only wildlife concern in the immediate area are a 2-mile buffer from a sage grouse lek and prairie dog town. The sage grouse lek will be addressed with a timing stipulation and the prairie dog town was addressed by moving locations and access routes a sufficient distance from the site. Block cultural surveys have been conducted on each location and applicable right-of-ways. All of these concerns identified by these studies can be easily be addressed without mitigation while staking the locations.

The drilling of the above locations will determine whether coalbed methane gas production is possible and economic. The coal seams targeted in the Cow Creek Area and Pod #6 will be the Mesaverde formation coals. Drilling locations are spaced on 40 acre spacing. This spacing is viewed by Double Eagle initially as the most warranted spacing since this area has only one (1) producing CBM well and therefore no reliable reservoir data exists to date. BLM's Reservoir Management Group identified The Cow Creek Pod or Pod #6 as having the only well testing coalbed methane in the proposed EIS area and "having the best economic coalbed methane potential due to its structural location".

These comments and others lead BLM to specify this area as the only one which would be allowed to discharge production water onto the surface. This discharge would be under a National Pollution Discharge Elimination System (NPDES) permit issue by the Wyoming Department of Environmental Quality (DEQ). Double Eagle is currently applying for a NPDES permit from the Wyoming Department of Environmental Quality which is designed to not increase impacts to the drainage

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basin and to explore alternative methods of containment and disposal of produced water. The NPDES permit will be discussed further in this Plan and is attached to the Water Management Plan which accompanies the APDs for each well.

All unproductive wells will be plugged and abandoned as soon as practical after the conclusion of production testing. Productive wells may be shut-in temporarily for gas pipeline connection or for authorization from the Wyoming DEQ for temporary or permanent surface water discharge permits and/or approval of sundry notices by the BLM for production activities and facilities.

All gas production and water production from Double Eagle operated wells will flow in underground pipelines to a Central Delivery Point (CDP) facility. The CDP will be located at the CCU #1X-12 wellsite in the NW¼SE¼ of Section 12, Township 16 North, Range 92 West. Once gas production enters the CDP it will be metered, compressed and sold into an existing third party gas sales lying beneath the CDP. Production water will enter the CDP and flow into an existing settling pond. From the pond, the water will be addressed in several ways as defined and approved by the Wyoming DEQ under the NPDES permit.

1. Existing Roads

- A. Access to the Cow Creek Area wellsites is obtained by road traveling approximately 38 miles South of Creston Junction, Wyoming. From the intersection of Interstate 80 and Highway 789 (Creston Junction Exit), proceed south toward Baggs, Wyoming on Highway 789 for approximately 31 miles to Dad, Wyoming. Turn left (east) at Dad and follow the main road for approximately 3 miles where the road forks. Take the left fork and continue on for 2 miles to the Cow Creek 1X-12 wellsite and Battery. This site will become the Central Delivery Point (CDP) of all Double Eagle wells discussed under the Master Surface Use Plan. For further reference, please see the area and topographic maps in the individual well Application for Permit to Drill (APDs) for the location of each well, access route and location of nearby roads.
- B. The existing roads are shown on an enclosed map. Existing roads will be maintained in as good or better condition than they now exist. All equipment and vehicles will be confined to these travel corridors and other areas specified in the plan of development.

2. Proposed Access Roads to be Constructed

- A. No new main roads will be needed to access wells in this program as existing two-track roads are already present and will represent the main corridors for access to the wellsites. However, new ancillary roads branching off these main roads to each location for access and utility trenches will require construction and are discussed later in the Plan. Each roadway access route will be 16 feet in width and be a dirt road which is crowned and ditched following the general terrain. Drainage crossings

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on the access routes will be constructed as low water crossings or with installation of culverts. Low water crossings will be employed in gentle sloping terrain as opposed to culverts which will be used in steeper terrain. Drainage structures will be designed to pass all naturally occurring mean flows.

- B. After wells are completed and equipment is installed, travel to wells will normally be limited to one visit per day. A light truck or utility vehicle will be used to check on operations, read meters, and provide light service during the life of the project. The integrity of all discharge facilities would be checked during these wellsite visits in addition to monitoring compliance with the NPDES permit, and ensure that all discharges occur only as planned and authorized. Well service trips could be rescheduled or postponed during periods of wet weather when vehicle travel could cause rutting.
- C. If wells are productive, the portions of access routes that provide access to the CDP facility will be upgraded to an all weather road to provide year around service. Road up-grading will consist of graveling the road way with scoria material that is acceptable to the surface owner. Culverts and other road drainage control structures will be installed at specific locations as specified by the landowner.
- D. All equipment and vehicles will be confined to these travel corridors and other areas specified in the plan of development.

3. Location of Existing Wells

All existing wells or locations known within one mile of the proposed Double Eagle locations are shown on the area and topographic maps in the individual well Application for Permit to Drill (APDs) for the location of each well.

- A. Water Wells: One, Non Producing
- B. Abandoned Wells: Eleven
- C. Temporarily Abandoned Wells: None
- D. Disposal Wells: None
- E. Drilling Wells: None
- F. Producing Wells: Two
- G. Completing Wells: None
- H. Shut In Wells: Three

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I. Injection Wells: None

J. Monitoring or Observation Wells: None

K. Proposed or Permitted Wells: 25

4. Existing and/or Proposed Facilities if Well is Successful

- A. There are no existing facilities on the wellsite locations.
- B. A graded wellpad with the dimensions of 180 feet by 200 feet will be constructed at the wellsite. A portion of these areas will be reclaimed and reseeded after drilling and completion operations are completed. All areas will be reclaimed and reseeded after operations are completed
- C. During operations, surface facilities at the wellsite will consist of a wellhead and insulated wellhead cover in an area approximately 10 feet by 10 feet. An area with the dimensions of 100 feet by 100 feet will not be reclaimed as such is needed for servicing the well. Each wellbore will have a pump installed to pump water from the coal formation thereby allowing for the release and production of natural gas. Exposed surface facilities will be painted Carlsbad Cavern colors approved by BLM.
- D. Two buried pipelines and one buried power cable, each appropriate in length to travel the distance from each wellsite on the defined access routes to the CDP will be installed between the well location and the CDP as shown on the enclosed map. The pipelines and power cable will be installed in the same trench. Each trench will 4 feet deep to prevent freezing of pipelines. The pipelines will be constructed of HDPE or steel pipe. One pipeline will transport the produced water and the other will transport the gas. A backhoe or small trencher will be utilized to dig the trench(s) thus, surface disturbance will be minimized.

5. Location and Type of Water Supply

Water for drilling, completing and dust control of the proposed wells will be obtained from the settling pond at the CDP located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 12, T16N, R92W. The water in the settling pond is production water from the CCU #1X-12 well. Water will be hauled by truck to the well locations over existing roads. Water volumes used in the operations is dependent upon the depth of the well and the losses that might occur during the operation.

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6. Construction Materials

No construction material will be needed for drilling purposes. There are no plans to use any federally owned material, but should that become necessary, the required approvals will be obtained prior to use. Construction and drilling activity will not be conducted using frozen or saturated soil material or during periods when watershed damage or excessive rutting is likely to occur. If production is established, gravel will be purchased from a local supplier and the material will be spread on the roadway for it to maintain all weather travel to the CDP facility.

7. Methods of Handling Waste Disposal

- A. All wastes that accumulate during the drilling operations will be contained in a trash cage that is fenced and completely enclosed with a fine wire mesh, and will be removed from the location and deposited in an approved sanitary landfill. Immediately after removal of the drilling rig, all garbage and debris on the site will be removed from the site. The reserve pit will not be utilized for trash disposal. All state laws and regulations pertaining to containment and disposal of human waste will be complied with.
- B. Double Eagle and its contractors shall ensure that all use, production, storage, transport and disposal of hazardous and extremely hazardous materials associated with the drilling, completion and production of wells, and project operations will be in accordance with all applicable existing or hereafter promulgated federal, state and local government rules, regulations and guidelines.
- C. For the protection of livestock and wildlife, all pits will be fenced “stock tight” and any pits containing toxic liquids will be netted with 2" mesh netting.
- D. Cuttings and drilling fluids shall be put in the reserve pit during drilling. A wire fence will be installed around the pit during drilling and after the drilling rig leaves. There will be no oil, salt water or other noxious fluids produced during drilling and completion operations.

8. Ancillary Facilities

It is anticipated that there will be a maximum of three (3) trailers on location during drilling and completion operations. Upon conclusion of the operations, the trailers or other facilities will be removed from the site.

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9. Wellsite Layout

- A. Please refer to the diagrams attached to the individual APDs or the Master Drilling Plan that shows each drill pad orientation with cuts and fills. Location dimensions are surveyed as 200' by 180' maximum area. However, the amount of area actually used for the drillsite will be dependent on the drilling rig used. The only grading of the wellsite will be the part of the location where the drilling rig and ancillary facilities are positioned. Within the location dimension, a temporary pit will be excavated measuring 15 feet wide and 15 feet long and 12 feet deep. The estimated life of the pit will be 2-3 weeks to allow for evaporation of pit fluids and will be reclaimed after completion operations. The pit will be fenced "stock tight" to prohibit livestock and wildlife from falling into it.
- B. Where grading occurs, the top 6 inches of soil material will be removed from the location, including areas of cuts, fill and subsoil storage areas, and will be stockpiled at the site. If ground frost prevents the segregation and removal of the topsoil material from the less desirable subsoil material, cross-ripping to the depth of the topsoil material will be completed as necessary.
- C. Care will be exercised to make certain that soil material and overburden will not be pushed over side-slopes or into drainages. All soil material disturbed will be placed in an area where it can be retrieved.
- D. If there is snow on the ground when construction begins, it will be removed before the soil is disturbed, and it will be piled downhill from the topsoil stockpile location.
- E. The backslope and foreslope will be constructed no steeper than 1.5:1. The reserve pit will be constructed with a minimum of one-half (½) the total depth below the original ground surface on the lowest point within the pit.
- F. The reserve pit will be fenced stock-tight on all sides when the well is suspended, completed or abandoned.
- G. The reserve pit will be oriented to prevent collection of surface runoff. The pad will be constructed in such a manner as to prevent water from draining across the pad.
- H. Block cultural surveys have been conducted on all locations and utility right-of-way corridors and have identified no negative impact from the proposed operations. However, if in connection with construction operations, the lessee/operator, his contractors, subcontractors, or the employees of any of them discover, encounter or become aware of any objects or sites of cultural value on the affected area, such as historical or prehistorical ruins, graves or grave markers, fossils, or artifacts, the lessee/operator shall immediately suspend all operations in the vicinity of the cultural value and notify the BLM Authorized Officer of the findings. Operations may

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resume at the discovery site upon receipt of written instruction and authorizations by the Authorized Officer, Bureau of Land Management.

10. Plans For Reclamation of the Surface

A. Reclamation procedures whether the well is completed as a successful production well or as a dry hole:

1. Rat and mouse holes if present will be filled immediately upon release of the drilling rig from the location.
2. All garbage, trash and debris will be removed and properly disposed of in accordance with paragraph number 7 of this Plan entitled Methods of Handling Waste Disposal.
3. The liquid contents of the reserve pit may be hauled to the next well to be immediately drilled or will be allowed to dry before backfilling, or pit fluids will be removed and disposed of in a manner approved by the Authorized Officer of the BLM before the reserve pit is backfilled.
4. All rehabilitation work, including seeding, will be completed within one(1) year of completion of the operation. The areas not needed for production purposes will be recontoured, top soil respread and seeded utilizing the seed mixture provided by the surface management agency.
5. All pits will be closed within 90 days after completion of operations or when the pit has dried out sufficiently to permit reclamation, but no case longer than one year after completion of operations without an extension approved by BLM.

B. Additional reclamation procedures if the well is completed as a dry hole:

1. A Notice of Intent to Abandon and Subsequent Report of Abandonment will be submitted to BLM for approval. A Final Abandonment Notice will be submitted when the rehabilitation is complete and the new vegetation is established.
2. An above-ground tubular metal dry-hole marker will be erected over the drill-hole location upon cessation of drilling and/or testing operations. The marker will be inscribed with the operator's name, well number, well location (¼ ¼, section, township, range, etc.) and federal lease number. Upon request of the surface management agency, the casing may be cut-off-three (3) feet below

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reclaimed ground surface (or below plow depth) with a metal plate affixed to the top providing the same well information as stated above. This monument will consist of a piece of pipe not less than four inches in diameter and ten feet in length, of which four feet shall be above the general ground level and the remainder being imbedded in cement. The top of the pipe will be closed by a welded or screw cap, cement or other means.

3. All disturbed areas will be restored as nearly as possible to resemble the surrounding terrain. Topsoil will be respread and reseeding will be done according to the directions of the surface management agency. Care will be taken to prevent erosion.

C. Additional reclamation procedures if the well is completed as a producing well:

1. Those disturbed areas not required for production operations will be recontoured to resemble surrounding terrain. No depressions will be left that trap water or form ponds.
2. The backslope and foreslope will be reduced to 2.5:1 by pulling fill material up from the foreslope and placing it into the toe of cut slopes.
3. If warranted, water bars at least one (1) foot deep will be constructed on the contour with approximately two (2) feet of drop per 100 feet of water bar to ensure drainage, and will be extended into established vegetation. All water bars will be constructed with a berm on the downhill side to prevent the soft material from silting in the trench. Water bar spacing on the location will be midway between the top and bottom of the backslope, and midway between the top and bottom of the foreslope.
4. Topsoil will be distributed evenly over those areas not required for production, and will be reseeded as recommended by the surface management agency.
5. To maintain quality and purity, certified seed with a minimum germination rate of 80% and a minimum purity of 90% will be used, in a mix directed by the surface management agency.

11. Surface Ownership

The surface estate of the access roads, drillsites and pipeline routes covered by this Plan are managed by the BLM.

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12. Other Information

An Environmental Assessment (EA) of the area covered by this Master Surface Plan is being prepared by Mr. Gary Holsan, P. O. Box 275, Thayne, Wyoming 83127. Once the document is completed it will be forwarded to BLM's office in Rawlins, Wyoming.

An in depth wildlife analysis has been conducted by Hayden-Wing Associates, P.O. Box 1689, Laramie, Wyoming 82073 in conjunction with the Atlantic Rim Environmental Impact Study. BLM has received a copy of this analysis.

All drillsite locations have been surveyed by a registered professional land surveyor.

Block cultural surveys for each quarter-quarter section where a wellsite, access road or pipeline route is located have been conducted by a BLM approved archeologist and is on file with BLM who will forward a copy of same to the State Historical Preservation Office (SHPO).

A Water Management Plan is attached to the Master Surface Use Plan that addresses how produced water will be handled during the testing and production of the CBM wells.

General factors on the area are described as follows:

- A. Topography – The wellsites located on generally flat terrain broken by small drainages. One (1) wellsite is situated on an abandoned wellsite. The main wellsite access route and one ancillary road are existing two-track roads.
- B. Soils – Soils in the area are sandy loam.
- C. Wildlife – Species present in the area include mule deer, antelope, rabbits, coyotes, fox, badgers, rodents and various birds.
- D. Vegetation – Species occurring within the area include mixed short grasses, low sagebrush, prickly pear cactus, phlox and creosote bush.
- E. Closest Residence – The closest residence to the proposed wellsite is approximately 4.6 miles to the southwest.
- F. Land use – The primary use of the subject land is livestock grazing and mineral production.

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13. Lessee or Operator's Certification

Double Eagle Petroleum Company, hereby certifies that said company is authorized to conduct operations on the above described land under the terms and conditions of Federal Oil And Gas Leases C-075345A, C-075345B, W-48862, WYW-131275 and Unit W-109471X. Bond coverage pursuant to 43 CFR 3104 is provided by Double Eagle Petroleum Company. The applicable bond number is on file in the Wyoming State Office, BLM Bond No. WY3224, a statewide oil and gas lease bond in the amount of \$25,000.00.

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drillsites and access routes; that I am familiar with the conditions which presently exist; that the statements made in this plan are, to the best of my knowledge, true and correct and that the work associated with the operations proposed herein will be performed by Double Eagle Petroleum Company and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved.

Double Eagle Petroleum Company

Name: _____
Stephen H. Hollis, President

Date: _____

APPENDIX C-2: Master Drilling Plan

Double Eagle Petroleum Company

P.O. Box 766
Casper, Wyoming 82602
(307) 237-9330

Cow Creek Area of Pod #6

Carbon County, Wyoming
June 15, 2001
Amended February 5, 2002

Double Eagle Petroleum Company is proposing the drilling of eight(8) exploratory coalbed methane (CBM) wells near and in the Cow Creek Unit or Pod #6 of the Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Study in Carbon County, Wyoming.

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The Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Statement allows for the drilling of 24 CBM wells in Pod #6 located in portions of Sections 12 of Township 16 North, Range 92 West and Sections 7, 17 & 18 of Township 16 North, Range 91 West, Carbon County, Wyoming. 10 wells located in Sections 8 and 17 of Township 16 North, Range 91 West will be operated by PEDCO/Warren Resources. The remaining 14 wells in Pod #6 will be operated by Double Eagle Petroleum. Of this total 14 wells, Double Eagle has two (2) existing wellbores, four(4) approved permits to drill and is proposing eight (8) additional locations. **This Master Drilling Plan focuses solely on those new proposed eight (8) locations to be operated by Double Eagle Petroleum.**

1. Wells to be covered by The Master Drilling Plan

<u>Well Name</u>	<u>Location</u>	<u>Survey</u>
CCU #12-7	Lot 6 (SW $\frac{1}{4}$ NW $\frac{1}{4}$) (7, T16N-R91W)	300 FWL/1,750 FNL
CCU #13-7	Lot 7 (NW $\frac{1}{4}$ SW $\frac{1}{4}$) (7, T16N-R91W)	500 FWL/2,400 FSL
CCU #14-7	Lot 8 (SW $\frac{1}{4}$ SW $\frac{1}{4}$) (7, T16N-R91W)	500 FWL/660 FEL
DBLE #24-7	SE $\frac{1}{4}$ SW $\frac{1}{4}$ (7, T16N-R91W)	660 FSL/1,650 FWL
DBLE #33-7	NW $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	1,980 FSL/1,980 FEL
DBLE #34-7	SW $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	660 FSL/1,980 FEL
DBLE #43-7	NE $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	660 FEL/1,980 FSL
DBLE #44-7	SE $\frac{1}{4}$ SE $\frac{1}{4}$ (7, T16N-R91W)	600 FEL/660 FSL

APPENDIX C-2: MASTER DRILLING PLAN

2. Estimated Important Geological Markers

<u>Horizon</u>	<u>Drilling Depth</u>
Lewis Shale	Surface
Mesaverde	910'
Total Depth	1,500'

3. Estimated Depth of Anticipated Water, Oil, Gas or Minerals

<u>Formation</u>	<u>Drilling Depth</u>	<u>Remarks</u>
Mesaverde	910'	Oil, Gas or Water

4. Operator's Minimum Specifications for Pressure Control

- A. A BOP schematic of the blowout preventer equipment which will consist of 2000 psi W.P. Double Ram, Hydraulic Preventer is enclosed. All fill, kill lines will be 2000 psi W.P. 0-160' no pressure control. 160'-1,500' 2,000# system. Note: This well is proposed as a "Coal Bed Methane" (CBM) well. A number of CBM wells drilled in the area indicate that the maximum anticipated surface pressure will not exceed 250 psi thus the BOP will only be tested to 1,000 psi.
- B. Testing Procedures
1. Ram type preventers and associated equipment shall be tested to 1,000 psi. Pressure shall be maintained for at least 10 minutes, or until requirements of test are met, whichever is longer.
 2. Tests will be run at the time of installation, prior to drilling out of casing shoe, whenever any seal subject to test pressure is broken, and at least every 30 days.
 3. All casing strings will be pressure tested to 0.22 psi/ft or 1,500 psi (whichever is greater) prior to drilling the plug after cementing. Test pressure will not exceed 70% of the minimum internal yield of the casing.
- C. Accessories to BOP's include upper and lower Kelly cock valves with handles and floor safety valve, drill string BOP.
- D. An accumulator unit will be used that has sufficient capacity to close all the equipment on the stack. The accumulator unit will be located at the master accumulator and on the rig floor. Hydraulic controls will be located at the master accumulator and on the rig floor. Manual controls (hand wheels) will also be installed on the blind and pipe rams. Refer to the enclosed exhibit for the diagram of the "Accumulator System and Hydraulic Controls".

5. Casing and Cementing Program

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- A. All new casing.
- B. Surface casing: 160' of 9-5/8", 36#/ft, J-55 STNC and cement to surface with 90 sacks of cement. Centralizers will be placed 5' off bottom of surface hole, and then one per joint. Cementing will consist of 90 sacks of Class G with 2% Calcium Chloride and 1/4 lb per sack of Flowcele with a weight of 15 lbs per gallon and a yield of 1.15 cubic feet per sack.
- C. Production casing: 1,500' of 7", 23#/ft, J-55, STNC, cemented with 225 sacks of cement. First Stage will consist of 125 sacks of Midcon 2 premium cement with a weight of 13 lbs per gallon and a yield of 2.0 cubic feet per sack. Second stage will consist of 100 sacks of Midcon 2 premium cement with a weight of 14.2 lbs per gallon and a yield of 1.59 cubic feet per sack. Anticipated top of cement is 400'.

6. Auxiliary Equipment

- A. A float will not be used.
- B. The pit will be monitored on a regular basis by a member of the drilling crew during the drilling of this well.

7. Mud Program

The mud system will consist of fresh water with appropriate weighting agents.

0' – 160' Fresh Water

160' – TD Fresh Water with weighting agents (9.0-12.0 lb fluids as dictated by hole conditions).

Note: An adequate supply of weighting agents will be on hand for the purpose of assuring well control.

8. Testing Logging and Coring Program

- A. The primary objective in this well is the Mesaverde Formation.
- B. No Drilling Stem Tests will be run.
- C. Logging: The following electrical logs will be run:
DIL/FDC/CNL – TD to surface casing
- D. Coring: the decision to collect cores will be determined based on drilling samples.

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- E. Well completion and stimulation procedures will be determined following the evaluation of drilling results and open hole logs. A “Sundry Notice” will be submitted outlining the planned completion procedure at that time.

9. Abnormal Pressures or Temperatures

- A. No abnormal temperatures have been noted or reported in wells drilled in the immediate area, nor at the depths anticipated in this well. The estimated static surface pressure is 250 psi or less. Anticipated Mesaverde Coals and Water Sands to be slightly over pressured.
- B. No H₂S is anticipated.

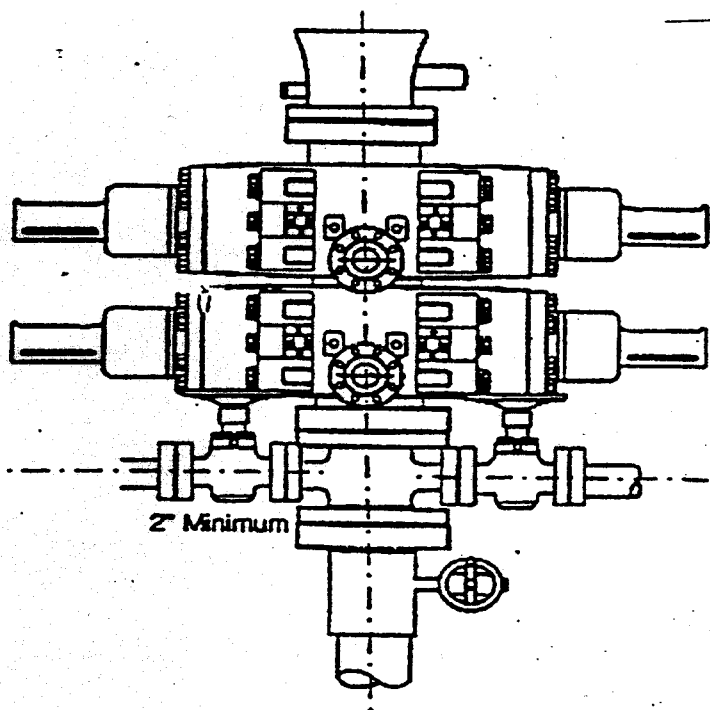
10. Starting Date and Duration of Operations

The anticipated starting date is approximately August 1, 2001. Each drilling and completion operation should be completed in 45 days after spudding the well.

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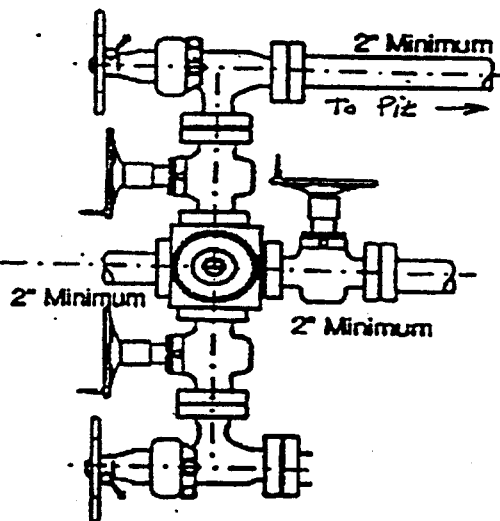
Double Eagle Petroleum Co.
Application for Permit to Drill
Cow Creek Unit Wells: 12-7, 13-7, 14-7, 24-7, 33-7, 34-7, 43-7, 44-7
Carbon County, Wyoming

BOP Schematic Diagram



2000 psi System

SIMPLE CHOKE SYSTEM



TYPICAL CHOKE MANIFOLD ASSEMBLY

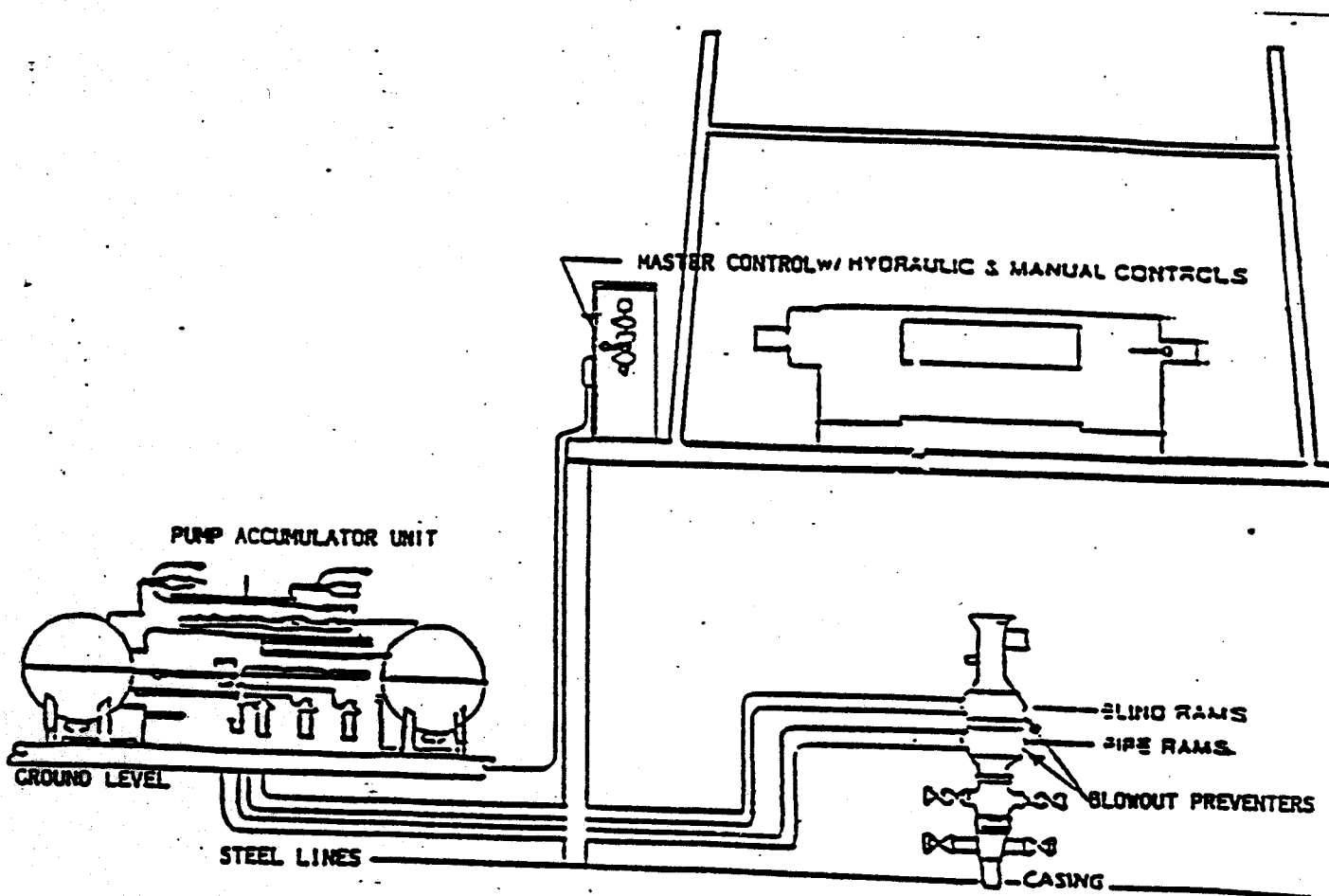
(Threaded or Flanged Connections)

NOTE: COAL BED METHANE / WATER (CBM) WELL
Test Pressures will be limited to 1000 psi

APPENDIX C-2: MASTER DRILLING PLAN

Double Eagle Petroleum Co.
Application for Permit to Drill
Cow Creek Unit Wells: 12-7, 13-7, 14-7, 24-7, 33-7, 34-7, 43-7, 44-7
Carbon County, Wyoming

BOP ACCUMULATOR SYSTEM & HYDRAULIC CONTROLS



APPENDIX C-3: WATER MANAGEMENT PLAN

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

WATER MANAGEMENT PLAN

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**DOUBLE EAGLE PETROLEUM AND
MINING COMPANY**

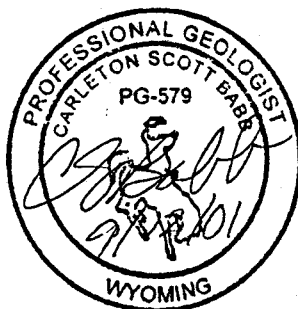
COW CREEK CBM PROJECT

**SECTIONS 12 & 13, T16N-R92W
SECTION 7, T16N-R91W
CARBON COUNTY, WYOMING**

WATER MANAGEMENT PLAN

Prepared for Double Eagle Petroleum & Mining Company

**Prepared by Carleton S. Babb, PG
Hydrogeologist
P.O. Box 4146
Casper, Wyoming 82604
307:234-7376
cnlbabb@wyoming.com
September 12, 2001**



DOUBLE EAGLE PETROLEUM & MINING COMPANY

COW CREEK CBM PROJECT

T16N-R91& 92W

Carbon County, Wyoming

WATER MANAGEMENT PLAN

Well Locations – Geographic Setting

Double Eagle Petroleum & Mining Company (DE) has proposed the development of their Cow Creek Unit and Pod #6 tracts of the Interim Drilling Plan associated with the Atlantic Rim Environmental Impact Study in Carbon County, Wyoming for Coal Bed Methane. The project will consist of 14 producing wells located in Sections 12 & 13, T16N-R92W and Section 7, T16N-R91W, Carbon County, Wyoming. The wells are initially on 40-acre spacing. There are two existing wells, four wells presently being drilled and eight proposed wells. Well details are presented in Table 2. The wells are also posted on Map 1. There will be one well at each surface location, each completed in the Mesaverde Coals. Six wells are permitted to discharge up to 125 gpm (4300 bpd, 0.28 cfs) of produced water into a Class 4 tributary to Dry Cow Creek, thence to the Little Snake River Conservation District (LSRCD) reservoir in Section 13, T16N-R92W. The balance of the produced water will be diverted to a new, off-channel reservoir and an aquifer recharge well. Estimated initial water production is 29 gpm per well. The total initial production from 14 wells will be approximately 409 gpm (0.91 cfs, 14,000 bpd). The water will be totally contained within the project area. A NPDES discharge permit has been obtained from the Wyoming Department of Environmental Quality utilizing DEQ Guideline Option 2 with one discharge point and one point of compliance.

The terrain consists of semi-arid to arid, relatively flat rangeland with occasional ridges composed of sandstone outcrops. Existing drainages are generally entrenched, but stable. The project tributaries discharge to Dry Cow Creek (Class 4), which, in turn, joins Cow Creek (Class 4), which joins Muddy Creek (Class 3), thence, the Little Snake River (Class 2). The project is approximately 40.5 stream miles from the Little Snake River.

The Cow Creek CBM project is a pilot project designed to test the economic and operational feasibility of methane recovery from the Mesaverde coals in the Green River basin. The project also presents the opportunity to test different options for handling the associated produced water. The project will generate valuable, site-specific data for use in planning and evaluating future development in the area. DE's 1X-12 well is the only CBM well presently producing to sales within the 310,000 acre Atlantic Rim EIS.

APPENDIX C-3: WATER MANAGEMENT PLAN

Watershed Delineation

The watershed impacted by this project is the unnamed tributary to Dry Cow Creek, referenced to the outlet of the LSRCD Reservoir in section 13. This drainage basin covers an area of 4.3 square miles. The watershed is shown on Map 1. The basin slope calculated for this watershed is 467 ft/mi.

Produced Water – Project Related

The project wells are expected to initially produce CBM water at the rate of 29 gpm (0.065 cfs, 1000 bpd) each. The total production for the 14 wells will be approximately 409 gpm (0.91 cfs, 14,000 bpd). The water production is expected to decline at an annual rate of 30 to 50% per year. Decline rates of 30 to 70% have been observed in the Powder River Basin CBM wells.

Table 1 presents the water quality analysis dated 7/27/00 for the 34-12 well completed in the Mesaverde Coals. The project wells are expected to produce water of similar quality. A summary of the produced water quality is as follows:

Total dissolved solids @ 180°C	1740 mg/l
Specific conductance @ 25°C	2770 umhos/cm
pH	8.33 su
Sulfate	<1.0 mg/l
Chloride	102 mg/l
Sodium adsorption ratio	60.7
Total radium 226	1.6 pCi/l
Total petroleum hydrocarbons	<1.0 mg/l
Dissolved iron	<30 ug/l
Total barium	920 ug/l
Total manganese	<10.0 ug/l
Total arsenic	0.50 ug/l

Table 2 lists the project well locations, discharge point and point of compliance. Existing wells are noted with an * and wells now being drilled with **. The Water Management Map (Map 1) also shows the locations of the proposed wells, discharge point and point of compliance.

Produced Water – Non-Project Related

Existing Wells

There are currently no non-project, producing CBM wells within the project watershed. There are two stock-water wells in the immediate vicinity of the project. The Cow Creek Unit 3-12 is located in the NW SE Section 12, T16N-

APPENDIX C-3: WATER MANAGEMENT PLAN

R92W. The well is owned by the BLM. It is plugged back to water zones at 934' to 1063'. The well is presently shut in. The second well is the J.O. Well 1 located in the NW NW Section 22, T16N-R91W; this is three miles east of the nearest DE proposed well. The well is owned by the BLM and is plugged back to 3000'. Water production is from an unknown interval. This is a flowing well, with water running into a low-lying area and reservoir, thence directly into Cow Creek.

The first well is completed in a zone above the Mesaverde coals and below the Lewis sands. Sufficient sealing facies should exist to isolate the producing zone in the water well from CBM activities. Given that the second well is located three miles east of the project area and regional geologic dips are westerly, it should not suffer any adverse impact from CBM production.

Potential Development

It is anticipated that additional leases within the project watershed will be developed in the future. A maximum development scenario for the drainage basin is 34 wells on 80-acre spacing with one well per location. This includes the 14 project wells. The total produced water discharged into this drainage at full development would be approximately 993 gpm or 2.2 cfs (34,000 bpd). This is a worst case scenario, assuming instantaneous full development, no production decline and no storage or conveyance loss. The actual development of this watershed will include all of these factors, which will result in a lower value for the actual full development water discharge rate.

Discharge Point Siting

The proposed pilot project will use one discharge point and one point of compliance (POC). These locations are listed in Table 2 and shown on Map 1. The discharge point is located in an established, ephemeral tributary of Dry Cow Creek. Up to 125 gpm (4300 bpd, 0.28 cfs) of produced water will be discharged to the unnamed tributary into the existing LSRCD Reservoir. The balance of the produced water will be diverted to a new, off-channel reservoir and an aquifer recharge well. The discharge point location has been developed in cooperation with the landowner and grazing lessee in the project area. Figure 1 is a diagram of the existing outfall.

No existing headcuts have been observed in drainages that will receive CBM water.

APPENDIX C-3: WATER MANAGEMENT PLAN

Mean Annual Flows

Mean annual flows were estimated for the project watershed above the LSRCD Reservoir (Table 3). These estimates were made using the Basin Characteristics Method and both area and channel widths (Lowham 1988). The input data are also shown in Table 3. The mean annual flows range from 0.07 to 0.12 cfs for this watershed. For comparison, the maximum initial project CBM flow will be approximately 0.91 cfs from 14 wells. However, the approved NPDES permit only allows 125 gpm (4300 bpd, 0.28 cfs) of discharge to the unnamed tributary into the existing LSRCD Reservoir.

Peak Flows

Peak flows were computed for the project watershed. Estimates were made using Lowham's Basin Characteristics Method. Peak flow estimates and input data are presented in Table 3. Peak flows range from $P_2 = 68.4$ cfs to $P_{500} = 1350$ cfs. The respective P_{10} and P_{25} values are 272 and 448 cfs. The P_{10} and P_{25} values were converted to 63.3 cfs/sq mi and 104 cfs/sq mi, respectively for use in culvert sizing. The maximum initial CBM flow for the 14 project wells is expected to be approximately 0.91 cfs and 2.2 cfs for full development of the watershed. If the P_{25} peak flow of 448 cfs is sustained for one hour, it will generate a water volume of 37 ac-ft. Expected CBM flows are much less than estimated natural peak flows for this watershed.

Channel Capacity

Channel capacity and respective velocity were estimated for this project at the discharge point using the Manning Equation. Input and results are presented in Table 3. Estimates were made for maximum channel capacity and water depth for the maximum discharge for the project. Bank full channel width and depth are 8 feet and 5 feet, respectively. When bank full, this channel has a capacity of 169 cfs at a velocity of 4.2 ft/sec. The estimated maximum project CBM flow of 0.9 cfs will result in a water depth of 0.25 feet and a velocity of 0.9 ft/sec.

Colorado River Issues

Due to the interstate agreements limiting salt loading to the Colorado River watershed, the following limits have been placed on the Cow Creek CBM project by the Wyoming Department of Environmental Quality:

- DE is being given credit for previous permitted discharge and will be allowed to discharge up to 125 gpm (4300 bpd, 0.28 cfs) to the unnamed tributary into the existing LSRCD Reservoir; the actual water rate will be dependent on the

APPENDIX C-3: WATER MANAGEMENT PLAN

salt load – the NPDES permit allows the total discharge of up to 1.34 tons of salt per day

- DE must maintain a freeboard of 2.5 ft in the LSRCD reservoir to accommodate the runoff from a 25-year precipitation event (37.8 Ac-ft)
- A point of compliance (POC) must be established below the LSRCD Reservoir
- NPDES permit standards must be met at the POC
- In effect, all CBM water must be totally contained within the project area
- DE will utilize a new, off-channel reservoir and a permitted aquifer recharge well to store and dispose of the water in excess of the LSRCD Reservoir allowable.

Due to the westward geologic dips and hydrologic gradients in the project area, the depths of the Mesaverde coals at the project site and the presence of aquitards above the producing zones, there should be no adverse impacts to ground-water zones contributing flow to tributaries of the Colorado River. In fact, the policy of total containment will result in most of the produced water reentering the local hydrologic system via the processes of infiltration, evaporation and transpiration.

Facility Design

Road Crossings

Project roads will utilize existing roads and trails and also include some new trails. These roads are shown on Map 1 as dashed black and red lines. The terrain at the project site is generally low relief, and will only require 18-inch culverts.

Head Cuts

No head cuts have been observed in the drainage that will receive CBM water from the Cow Creek project. The one tributary receiving surface discharge will be monitored regularly for erosion. Any adverse impacts will be promptly mitigated by DE using best management practices.

Culverts

The locations for 17 new and existing culverts are posted on Map 1. An 18-inch culvert will be installed at each of the new locations.

Reservoirs

There is one existing reservoir within the project area (LSRCD). One new, off-channel reservoir will also be constructed. Table 4 lists the reservoirs, their

APPENDIX C-3: WATER MANAGEMENT PLAN

locations and specific reservoir data, including capacities. The reservoirs are also shown on Map 1. The new reservoir is documented in Figure 2 and will be permitted with the Wyoming State Engineer prior to commencing any construction activities. Total water losses for the two reservoirs are estimated at 400 and 200 gpm, respectively.

Aquifer Recharge Well

An aquifer recharge well will be installed at the aquifer recharge facility shown on Map 1. The recharge well will be drilled to approximately 400 ft and completed in the Lewis sands (Figure 3). The well diameter will be 5.5 inches. 200 ft of injection head should be available, which will allow the well to gravity-inject CBM water into the Lewis sands. Table 5 presents various injection rates for different transmissivities (T) and times (t). The maximum rate of 276 gpm (9464 bpd) would occur with $T = 3000$ gpd/ft and $t = 1$ day. A minimum rate of 36 gpm (1234 bpd) would occur with $T = 500$ gpd/ft and $t = 1460$ days (4 years). This well has been permitted with WDEQ and is being installed to gather site-specific data. The westward geologic dips and hydrologic gradients in the project area should carry the recharge water deeper into the basin.

Water Balance

Tables 6 & 7 are water balances run for the project with the initial rate of 29 gpm per well and no decline. Table 6 assumes water losses from the LSRCD reservoir, one off-channel reservoir and one recharge well. The result is an excess capacity of 639 ac-ft/yr (more outflow than inflow). An injection rate of 200 gpm was used for the recharge well. Precipitation is accounted for with the freeboard buffer in the LSRCD reservoir; the off-channel reservoir and recharge well are really not affected by precipitation.

The water balance in Table 7 demonstrates the effect of the limit on produced water being discharged to the LSRCD reservoir. This reduces the water loss available to the project, but still results in a net annual excess capacity of 193 ac-ft and total containment is still achieved.

If additional loss capacity is required, options include, but are not limited to:

- Installation of additional recharge wells
- Installation of additional off-channel reservoirs
- Evaporation enhancement using spray nozzles
- Recomplete an abandoned wellbore as either a recharge or disposal well.

APPENDIX C-3: WATER MANAGEMENT PLAN

Stock "Tanks"

No new stock watering stations will be installed at this project.

Erosion Control Plan

If any head cuts should develop due to CBM surface flow, the head cuts will be mitigated by cutting the profile slope back to 5:1 to 10:1, as appropriate. Side slopes will be 3:1. The active channel will be rip-rapped with coarse, crushed or native rock. Geofabric will be laid beneath the rock, if necessary. The area will then be reseeded.

Downstream Impacts

There are no downstream concerns that need to be addressed by DE. The CBM water discharged from this project will be contained within the project area. Since produced water will not leave the project area, there will be no downstream impacts. There is no irrigation from Dry Cow Creek or Cow Creek, both Class 4 waters downstream of the project. If produced water from this project should affect downstream areas, DE will work with the respective surface owners to mitigate any problems.

Monitoring

Each discharge point will be monitored monthly for the first year of operation. Inspectors will note the condition of the discharge point, check for evidence of erosion and schedule any remedial work, if required.

All dam outlets (spillways and pipes) will be checked quarterly, or after major storm events for the first year of operation. Inspectors will note the condition of the outlets, check for evidence of erosion and schedule any remedial work, if required.

Any stabilized head cuts will be inspected for signs of erosion or structural failure. Inspectors will note the condition and schedule remedial work, if required.

The channel and crossings on Dry Cow Creek, immediately below the project, will be inspected for signs of accelerated erosion due to the continuous flow of produced CBM water, if it occurs.

APPENDIX C-3: WATER MANAGEMENT PLAN

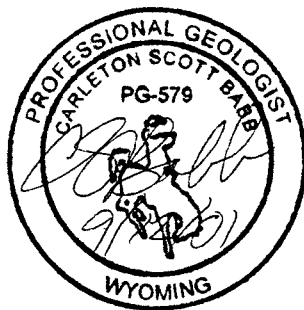
After the first year of operation, inspections will only occur annually, unless specific sites have required remedial action.

LESSEE'S OR OPERATOR'S REPRESENTATIVE AND CERTIFICATION

I hereby certify that I, or persons under my direct supervision, have inspected the watershed area(s) affected by our coal bed methane drilling and production plans; that I am familiar with the conditions that currently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and that the work associated with operations proposed herein will be performed by Double Eagle Petroleum & Mining Company and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved. This statement is subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

Date September 12, 2001

Name and Title Carleton S. Barb
Hydrogeologist



Double Eagle/cc wmp

Map 1.
Water Management Plan
Double Eagle Petroleum
Cow Creek CBM Project

LEGEND

- Pod Boundary
- Drainage Basin
- Unimproved 2-Track Road
- Road & Utilities Corridor
- Utilities Corridor
- Water Line
- Point of Compliance
- Water Discharge Point
- Existing Well
- Proposed Well
- CDP Central Delivery Point
- C Culvert

0.5 0 0.5 Miles

OUTFALL TO LSRCD RESERVOIR

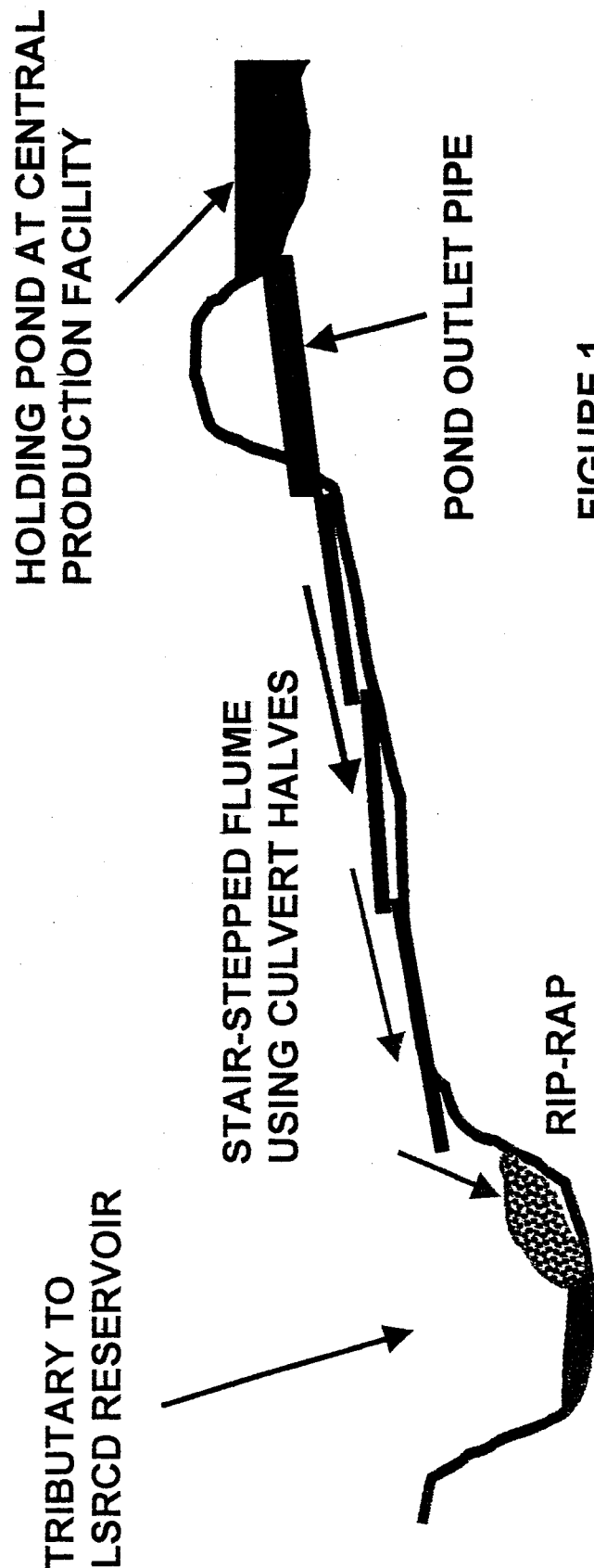


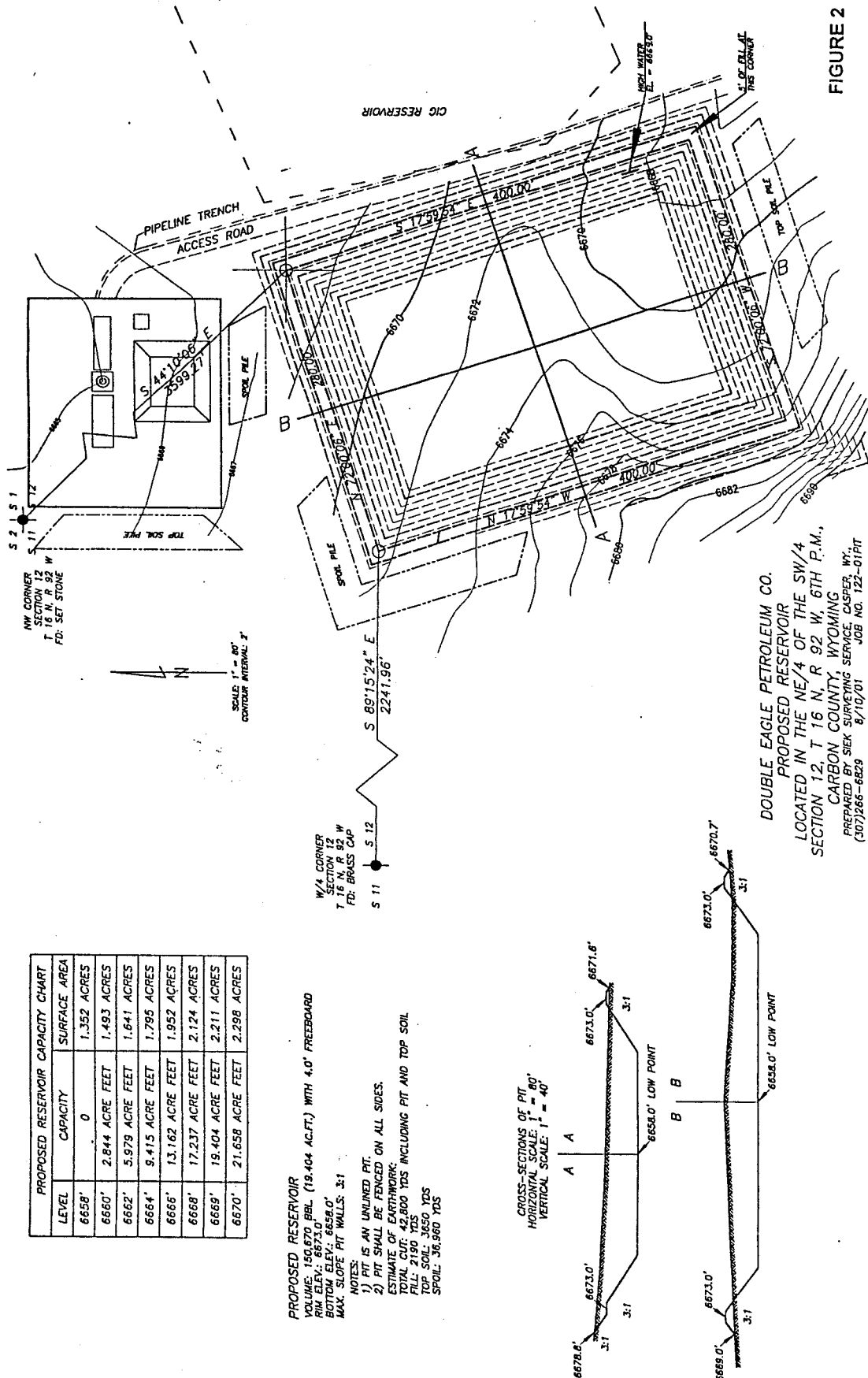
FIGURE 1

Double Eagle Petroleum
and Mining Company
Cow Creek CBM Project

DIAGRAMMATIC CROSS-SECTION
NOT TO SCALE

CSB 8/23/01

APPENDIX C-3: WATER MANAGEMENT PLAN



AQUIFER RECHARGE WELLS

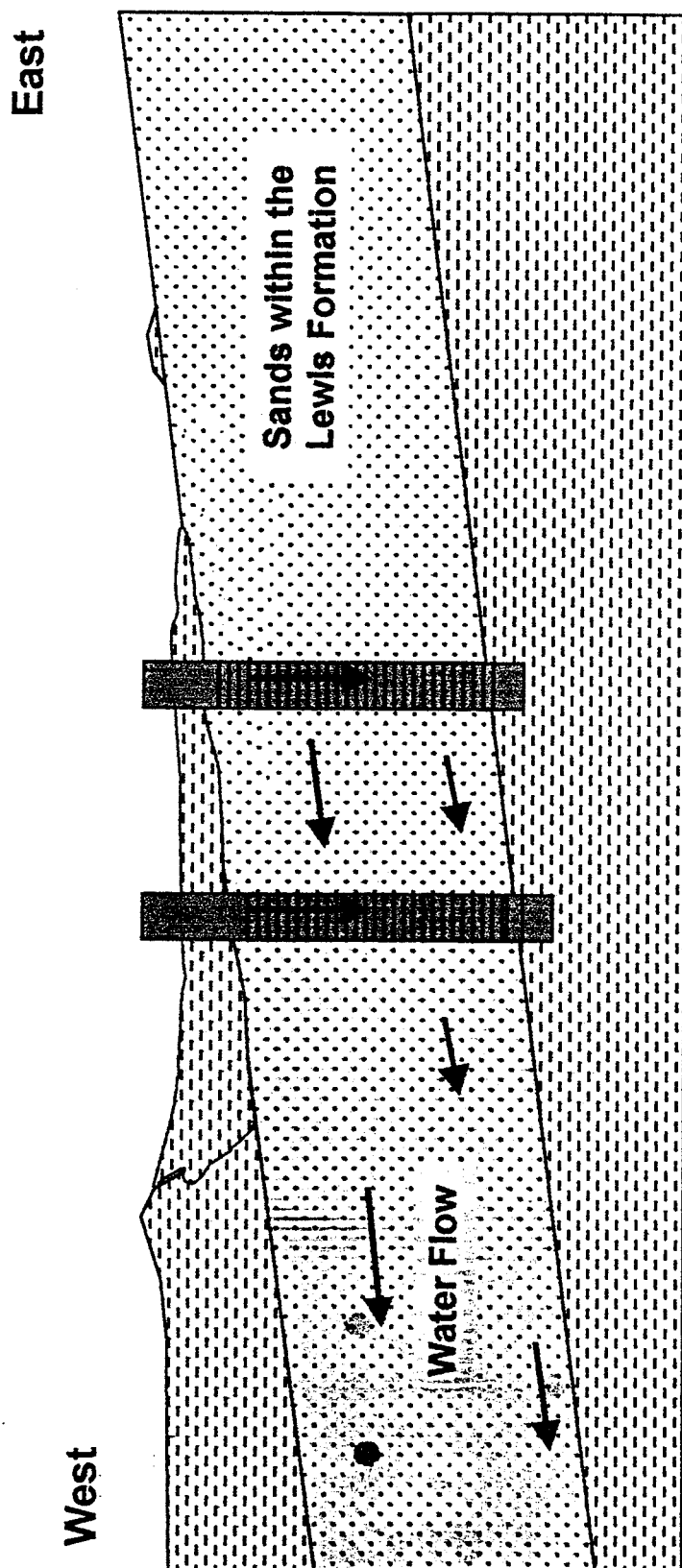


FIGURE 3

Not to Scale

CSB 8/23/01

Double Eagle Petroleum
Cow Creek CBM Project

HEAD CUT MITIGATION

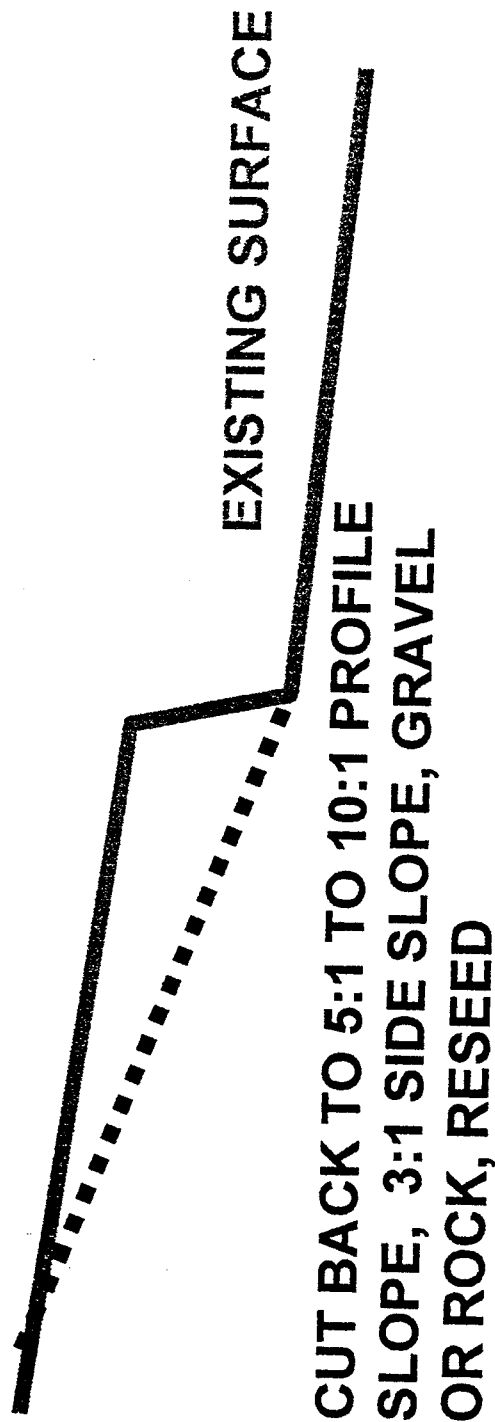
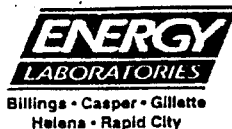


FIGURE 4

NOT TO SCALE

APPENDIX C-3: WATER MANAGEMENT PLAN



ENERGY LABORATORIES, INC.

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MAILING: P.O. BOX 3258 • CASPER, WY 82602
E-mail: energy@trib.com • FAX: (307) 234-1639
PHONE: (307) 235-0515 • TOLL FREE: (888) 235-0515

TABLE 1

LABORATORY ANALYSIS REPORT			
Client:	DOUBLE EAGLE PETROLEUM & MINING COMPANY		
Attention:	Steve Degenfelder		
Project:	CCU IX-12		
Sample Matrix:	Liquid, Water		
Sample ID:	34-12		
Laboratory ID:	002-00-34698		
Sample Date/Time:	07/27/2000 10:00		
Date/Time Received:	07/27/2000 16:18		
Report Date:	August 16, 2000		
Sample Type:	DOUBLE EAGLE PETROLEUM & MINING COMPANY		
Company:	Steve Degenfelder		
NPDES Permit / Outfall #:			
Quarter Section:			
Section:			
Township:			
Range:			
CBM Database:			
Total Depth, ft.			
Well Elevation, ft.			

Major Ions	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Calcium	4.5	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai
Magnesium	2.0	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai
Sodium	630	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai
Potassium	7.8	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai
Chloride	102	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai
Bicarbonate	1670	mg/L	1.0	SM 2320-B	08/03/00	14:49	lm
Sulfate	< 1.0	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai

Non-Metals	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Cyanide, total	< 5.0	ug/L	5.0	EPA 335.3	07/28/00	17:09	eli-b
Hardness as CaCO ₃	20.2	mg/L	10.0	EPA 200.7	08/03/00	9:07	jai
pH	8.33	std. units	0.01	SM 4500-H-B	08/03/00	14:49	lm
Phenol, total	40.0	ug/L	10.0	EPA 420.1	08/02/00		jl
Sodium Adsorption Ratio	60.7	mg/L	1.0	EPA 200.7	08/03/00	9:07	jai
Specific Conductance @ 25°C	2770	umhos/cm	1.0	SM 2510-C	08/01/00	10:56	jr
Total Dissolved Solids @ 180°C	1740	mg/L	1.0	SM 2540-C	08/01/00	13:48	jr
Total Petroleum Hydrocarbons	< 1.0	mg/L	1.0	EPA 418.1	07/28/00	10:43	mm

Trace Metals	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Aluminum, total	< 50.0	ug/L	50.0	EPA 200.7	08/03/00	9:07	jai
Antimony, total	< 5.0	ug/L	5.0	EPA 200.8	08/10/00	10:35	ts
Arsenic, total	0.50	ug/L	0.10*	EPA 200.8	08/07/00	17:10	eli-b
Barium, total	920	ug/L	100	EPA 200.7	08/03/00	9:07	jai
Beryllium, total	< 0.10	ug/L	0.10	EPA 200.8	08/07/00	17:10	eli-b
Boron, total	1070	ug/L	100	EPA 200.7	08/03/00	9:07	jai
Cadmium, total	< 0.10	ug/L	0.10	EPA 200.8	08/10/00	10:35	ts
Chromium, total	1.0	ug/L	1.0	EPA 200.8	08/10/00	10:35	ts
Copper, total	3.0	ug/L	1.0	EPA 200.8	08/03/00	9:07	jai
Iron, dissolved	< 30	ug/L	30.0	EPA 200.7	08/09/00	12:01	jai
Iron, total	310	ug/L	30.0	EPA 200.7	08/03/00	9:07	jai
Lead, total	< 2.0	ug/L	2.0	EPA 200.8	08/10/00	10:35	ts
Manganese, dissolved	< 10.0	ug/L	10.0	EPA 200.7	08/09/00	12:01	jai
Manganese, total	< 10.0	ug/L	10.0	EPA 200.7	08/03/00	9:07	jai
Mercury, total	< 0.10	ug/L	0.10	EPA 245.1 Mod.	08/07/00	17:10	eli-b
Nickel, total	< 10.0	ug/L	10.0	EPA 200.8	08/10/00	10:35	ts
Selenium, total	< 5.0	ug/L	5.0	EPA 200.8	08/10/00	10:35	ts
Silver, total	< 3.0	ug/L	3.0	EPA 200.8	08/10/00	10:35	ts
Thallium, total	< 10.0	ug/L	10.0	EPA 200.8	08/10/00	10:35	ts
Zinc, total	130	ug/L	10.0	EPA 200.7	08/03/00	9:07	jai

Radiochemical	Results	Units	Practical Quantitation Limit	Analysis Method	Analysis Date	Analysis Time	Analyst
Radium 226	1.6	pCi/L	0.2	EPA 903.0	08/09/00		rs
Precision ±	0.2	pCi/L					

Quality Assurance Data	Target Range
Anion	30.3
Cation	28.0
SM A/C Balance	-5 - +5
Cate TDS	1583
TDS A/C Balance	0.80 - 1.20

* 0.10 ug/L is currently the lowest available detection limit for Arsenic.

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COMPLETE ANALYTICAL SERVICES

TRACKING NO. PAGE NO.

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APPENDIX C-3: WATER MANAGEMENT PLAN



Billings • Casper • Gillette
Helena • Rapid City

ENERGY LABORATORIES, INC.

SHIPPING: 2393 SALT CREEK HIGHWAY • CASPER, WY 82601

MAILING: P.O. BOX 3258 • CASPER, WY 82602

E-mail: energy@trib.com • FAX: (307) 234-1639

PHONE: (307) 235-0515 • TOLL FREE: (888) 235-0515

LABORATORY ANALYSIS REPORT, TPH USING EPA 418.1

ANALYTICAL RESULTS

Client: Double Eagle Petroleum & Mining Co.
Project: CCU 1X-12
Matrix: Liquid - WATER

Date Sampled: 07-27-00
Time Sampled: 10:00
Date Received: 07-27-00
Date Reported: July 28, 2000

ANALYTE CONCENTRATION

Laboratory ID	Sample ID	Volume, mL	Absorbance	Dilution Factor	TPH Result, mg/L	Date, Time Analyzed
00-34698-2	34-12	975	0.008	1	< 1.0	07-28-00 10:44

Quality Assurance Report

Instrument Calibration 07/28/00:

Concentration, mg/L in Freon
Concentration, mg/L if 1 liter sample
Absorbance:
Correlation Coefficient:
Slope:
Intercept:
Analyst:

0	10	25	50	75	100
0	1.0	2.5	5.0	7.5	10.0
0.000	0.076	0.202	0.400	0.604	0.760

0.9991

129

-0.609

mmc

QCS Sample Analysis (spike) 07/28/00 10:40:

Sample Number	Sample ID	Absorbance	Response	Expected Response	%	Date, Time Analyzed
QCS0728	QCS	0.372	4.74	5.00	94.8%	07-28-00 10:40
Acceptance Range:					75 - 125 %	

Method Blank:

Sample ID	Volume, mL	Absorbance	Dilution Factor	Result, mg/L	Date, Time Analyzed
MB0728A	1000	0.000	1	< 1.0	07-28-00 10:33

ND - Analyte not detected at stated limit of detection

METHODS USED IN THIS ANALYSIS:

EPA 418.1

ec: r:\reports\clients2000\double_eagle_petroleum\casper_org\34698-1-3_4181_l-w.xls

Analyst: mmc

COMPLETE ANALYTICAL SERVICES

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APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 2

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

WELL, DISCHARGE POINT, & POINT OF COMPLIANCE LOCATIONS

<u>Well</u>	<u>STR</u>	<u>Well Location</u> <u>Qtr/Qtr</u> <u>Lat-Long</u>	<u>API</u>	<u>Discharge</u> <u>Point</u>	<u>Receiving</u> <u>Stream</u>
CCU 1X-12 *	12-T16N-92W	NW SE 41.37107, 107.69301	49-007-05094	001	Tributary to Dry Cow Creek
CCU 34-12 *	12-T16N-92W	SW SE 41.36722, 107.69444	49-007-21601	001	Tributary to Dry Cow Creek
CCU 32-12 **	12-T16N-92W	SW NE 41.37467, 107.69493	49-007-21921	001	Tributary to Dry Cow Creek
CCU 42-12 **	12-T16N-92W	SE NE 41.37446, 107.69021	49-007-21919	001	Tributary to Dry Cow Creek
CCU 43-12 **	12-T16N-92W	NE SE 41.37107, 107.69070	49-007-21918	001	Tributary to Dry Cow Creek
CCU 44-12 **	12-T16N-92W	SE SE 41.36703, 107.69025	49-007-21920	001	Tributary to Dry Cow Creek
CCU 12-7	7-T16N-R91W	SW NW (Lot 6)		001	Tributary to Dry Cow Creek
CCU 13-7	7-T16N-R91W	NW SW (Lot 7)		001	Tributary to Dry Cow Creek

APPENDIX C-3: WATER MANAGEMENT PLAN

Table 3

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

BELOW COW CREEK RESERVOIR
Sec. 12 & 13, T16N-R92W, Carbon County, Wyoming

PEAK FLOWS (Lowham, 1988; Basin characteristics method - High Desert Region)

Drainage Basin Area, sq mi	4.3	
Geographic Factor	1.1	
Basin Slope, ft/mi	467	
Average Annual Precipitation, inches	10.5	
P ₂	68.4 cfs	
P ₅	171 cfs	
P ₁₀	272 cfs	P ₁₀ = 63.3 cfs/sq mi
P ₂₅	448 cfs	P ₂₅ = 104.2 cfs/sq mi
P ₅₀	606 cfs	
P ₁₀₀	797 cfs	
P ₂₀₀	999 cfs	
P ₅₀₀	1350 cfs	

MEAN ANNUAL FLOW (Lowham, 1988)

Location: POC	
Drainage Area, sq mi	4.3
Avg. Annual Precipitation, in.	10.5
Channel width, ft	8
Mean Annual Flow, cfs (A&P)	0.12
Mean Annual Flow, cfs (W)	0.07

CBM FLOW

Project: 14 wells @ 29 gpm/well = 406 gpm = 0.91 cfs

CHANNEL CAPACITY (Manning Equation)

		Maximum	Project CBM only
width	ft	8	4
depth	ft	5	0.25
slope	ft/ft	0.0025	0.0025
roughness		0.03	0.03
velocity	ft/sec	4.2	0.9
discharge	cfs	169.2	0.9

cow ck hydro A

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APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 4

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

RESERVOIR DATA

<u>RESERVOIR</u>	<u>HW AREA</u> acres	<u>MAX WTR</u> <u>DEPTH</u> feet	<u>AVG WTR</u> <u>DEPTH</u> feet	<u>CAPACITY</u> ac-ft
LSRCD	15.8	23	7.7	121
Recharge Facility	2.2	11	8.8	20

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 5

**DOUBLE EAGLE PETROLEUM & MINING COMPANY
COW CREEK CBM PROJECT**

INJECTION RATES

SINGLE WELL GRAVITY INJECTION INTO LEWIS SANDS
200 FT MAXIMUM INJECTION HEAD (400 FT HOLE, 5 1/2 INCH DIAMETER)

SUMMARY OF MAXIMUM RATES, GPM/BPD
USING DIFFERENT TRANSMISSIVITIES & TIMES

TIME, DAYS	TRANSMISSIVITY, GPD/FT		
	3000	1000	500
1	276	98	51
	9464	3360	1749
365	211	73	38
	7235	2503	1303
1460	200	69	36
	6858	2366	1234

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APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 6

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

WATER BALANCE

AT LSRCD RESERVOIR

INFLOW excluding precipitation

<u># of wells</u>	<u>Formation</u>	<u>gpm/well</u>	<u>cfs/well</u>	<u>Total project flow (cfs)</u>	<u>Annual flow volume (cu feet)</u>	<u>Annual flow volume (acre-feet)</u>
6	Kmv coal	29	0.065	0.390	12291471	282
8	Kmv coal	29	0.065	0.520	16388628	376
14				0.909		658

OUTFLOW

<u>Reservoir</u>	<u>Capacity (acre-feet)</u>	<u>Estimated combined evaporation and seepage rate (gpm)</u>	<u>(cfs)</u>	<u>Estimated annual losses due to evaporation and seepage (acre-feet)</u>
LSRCD	120	400	0.896	649
Rechg. Reservoir	20	200	0.448	324
Subtotal	140			973
<u>Recharge Well</u>		200	0.448	324
Total Outflow				1297
OUTFLOW (acre-feet)	-	INFLOW (acre-feet)	=	EXCESS CAPACITY (acre-feet)
1297		658		639

cc wtr bal

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8/23/01

APPENDIX C-3: WATER MANAGEMENT PLAN

TABLE 7

DOUBLE EAGLE PETROLEUM & MINING COMPANY COW CREEK CBM PROJECT

WATER BALANCE

AT LSRCD RESERVOIR

INFLOW excluding precipitation

<u># of wells</u>	<u>Formation</u>	<u>gpm/well</u>	<u>cfs/well</u>	Total project flow (cfs)	Annual flow volume (cu feet)	Annual flow volume (acre-feet)
6	Kmv coal	29	0.065	0.390	12291471	282
8	Kmv coal	29	0.065	0.520	16388628	376
14				0.909		658

OUTFLOW

<u>Reservoir</u>	<u>Capacity (acre-feet)</u>	Estimated combined evaporation and seepage rate		Estimated annual losses due to evaporation and seepage (acre-feet)
		<u>gpm</u>	<u>(cfs)</u>	
Rechg. Reservoir	20	200	0.448	324
<u>Flow to LSRCD Res.</u>		125	0.28	203
<u>Recharge Well</u>		200	0.448	324
Total Outflow				851
OUTFLOW (acre-feet)	-	INFLOW (acre-feet)	=	EXCESS CAPACITY (acre-feet)
851		658		193

cc wtr bal

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8/23/01